IN THE SPECIFICATION:

[0001] Force detection devices have been commonly used in the prior art for rehabilitation from injuries caused by trauma to lower limbs. A large percentage of joggers and runners become injured in some fashion while running. Most of these joggers and runners do not realize that an improper stride may directly lead to, or at a minimum, contribute to these injuries. Overstriding is one example of an improper stride used by runners. Webster'[[“]]s dictionary defines overstride as “to stride over or beyond.” Overstriding most often occurs when a moving person'[[“]]s foot strikes the ground in a position in front of a point directly below the runner'[[“]]s center of gravity. In this situation, the center of gravity is located just above the center of the pelvis when that person is running, and when a runner’s foot strikes the ground too far in front of the center of gravity, the foot acts to brake or slow down the runner’s momentum. The foot can land on the ground in a propping or braking position. When this happens, the foot[[“]]'s impact retards the forward motion of the body, and additional energy must be then expended to compensate for the loss.

[0002] A typical foot strike creates large impact forces which are mostly absorbed by the body'[[“]]s muscles, tendons, and ligaments. Any misalignment or imbalance in the gait can turn into a problem due to the repetition of the movements in walking, jogging or running. Most joggers and runners are unaware of these misalignments or imbalances, and of the loss of forward motion associated with inefficient strides, and many can spend an entire lifetime of running or jogging without knowing how much more economical their running or jogging action

would be if they learned to adjust to a more efficient stride. For example, some runners may need to reduce their overall stride length and pick up their cadence to achieve the desired strides in their gait.

[0003] Misalignment caused by overpronation in the leg can also lead to a whole host of injuries in areas higher in the limbs such as the knees and hip joints. Excessive supination, or the outward rolling of the foot, is not as common but can lead to similar debilitating effects over a period of time. Lack of any pronation can lead to excessive force being distributed throughout the body as the foot is not able to absorb the impact force. Some examples of typical injuries related to running and jogging are:_achilles tendinitis, arthritis of the foot and ankle, ankle pain, arch pain, back pain, bunions, calf strain, clubfoot, corns, fractures of the heel, groin pull, hammertoes, hamstring pain, heel pain, hip pain, iliotibial band syndrome, knee pain (or runner's knee), morton's neuroma (persistent pain in the ball of your foot) , neck & shoulder pain, overpronation, shinsplints, side stitches, sprained ankle, stress fractures of the foot and ankle, thighbone fracture, toe and forefoot fractures. All of the aforementioned maladies can be caused or exacerbated by an inefficient running stride.

[0003] Misalignment caused by overpronation in the leg can also lead to a whole host of injuries in areas higher in the limbs such as the knees and hip joints. Excessive supination, or the outward rolling of the foot, is not as common but can lead to similar debilitating effects over a period of time. Lack of any pronation can lead to excessive force being distributed throughout the body as the foot is not able to absorb the impact force. Some examples of typical injuries

related to running and jogging are: achilles tendinitis, arthritis of the foot and ankle, ankle pain, arch pain, back pain, bunions, calf strain, clubfoot, corns, fractures of the heel, groin pull, hammertoes, hamstring pain, heel pain, hip pain, iliotibial band syndrome, knee pain (or runner's knee), morton's neuroma (persistent pain in the ball of your foot) , neck & shoulder pain, overpronation, shinsplints, side stitches, sprained ankle, stress fractures of the foot and ankle, thighbone fracture, toe and forefoot fractures. All of the aforementioned maladies can be caused or exacerbated by an inefficient running stride.

[0008] The apparatus includes a body force alarming apparatus comprising a housing, a power supply, a piezo sensor, a controller, and an output generator, wherein said piezo sensor is accommodated within a user'[["]]s shoe and connected to said controller, wherein said piezo sensor, controller and said output generator are connected to said power supply, wherein said controller, output generator and power supply are accommodated within said housing, wherein said controller is connected to said output generator, wherein said controller is set to generate a signal to the output generator when a threshold level of force signal is received from said piezo sensor, wherein said sensor signals said controller when force from an impact is applied to said piezo sensor, wherein said controller signals said output generator when one or more signals indicating threshold levels of force have been reached, and wherein said output generator generates a perceivable signal in response to a signal from said controller.

[0009] An embodiment of the body force alarming apparatus includes two or more piezo sensors to provide feedback when one or more levels of force are sensed instead of one. Another

embodiment includes a means to automatically adjust the controller. Another embodiment of the present invention includes a microcontroller wherein said microcontroller, once activated by a user with a switch, performs the steps of recording one or more impact levels for a predetermined period of time, averaging said amounts of impact recorded over said period of time; and setting the controller'[[“]]s feedback threshold to an amount above or below the average value. Yet another embodiment includes a microcontroller wherein said microcontroller, once activated by a user with a switch, performs the steps of recording one or more impact levels for a predetermined period of time, averaging said amounts of impact recorded over said period of time; and setting the controller'[[“]]s feedback threshold to an amount greater than said average.

[0011] Yet another embodiment of the body force alarming apparatus includes an impact transducer. Another embodiment of the body force alarming apparatus includes the sensor, controller and feedback generator accommodated within a person'[[“]]s shoe. Another embodiment of the body force alarming apparatus includes a perceivable signal that is an audio beep, a musical tone or tones, a click, a vibration, a shock, a pressure applied to the user, or a light emission.

[0026] Lead wires are either already connected to the piezo sensors as purchased or they are connected after the product is cut. The piezo sensor is connected by a wire to controller which is designed to receive and evaluate the signals from the sensor. The sensor in one embodiment is placed inside a user'[[“]]s shoe, under the sole of the foot. The sensor can be placed within a

user'[[“]]s shoe, for example it can be contained in a user's insole, midsole, or it can be placed within other areas of the shoe. It can also be affixed with adhesive to a portion of an insole, midsole or the shoe itself. It can also be placed anywhere on the body to measure impact at that point on the body.

[0029] Before the embodiments of the present invention are initially used, they are pre-set to generate output when at least one specific amount of force is sensed by the controller. In later steps, the controller is set to generate a signal to the output generator when a threshold level of force signal is received from said sensor. This is initially set before the first use to produce an output signal when a certain amount of impact force is sensed, and this amount is approximately 50 percent of a two hundred pound human'[[“]]s weight. This can be changed at any time before or after the initial use based on the user's preferences.

[0030] The auto adjusting features of other embodiments can be used in different ways with the main goal which is to allow auto adjusting of the controller so that the level of desired feedback is set automatically to the user'[[“]]s preference. The threshold levels can be auto adjusted to various levels depending on level of feedback desired and the amount of impact generated by the user.

[0031] In one embodiment, a runner can run with his or her normal stride to calibrate the base threshold level. The controller can be set to “learn mode” or “auto-calibrate mode” from a user originated action such as pressing a “calibrate mode” button found on the outside of the housing 12. Controller, now in learn mode, can receive and record the impact force levels from the

sensor over a predetermined period of time, approximately 20 seconds, or until learned mode is turned off by the user with a second pressing of the "calibrate mode" button or until the time has run out.

[0032] After the "learn mode" is completed, the controller determines the threshold level 100 based on the average impact force levels recorded during the learn mode function. The controller then stores this threshold level 100 into the controller'[["]]s internal memory, where it can then be used in conjunction with determining whether or not to produce a signal to the output generator. The learn mode results can be stored as threshold level 100 or, in an alternative embodiment, the learn mode results can be changed to add or subtract a percentage before they are stored as threshold level 100. The threshold level 100 can also be changed after the learn mode results have been stored as threshold level 100. For example, a runner uses the auto adjust learn mode to adjust the controller to his or her preference, and the controller can add 10 percent so that if the runner goes over his or her preference by more than 10% impact, the controller will generate a signal to the output generator and a perceivable signal will be heard by the runner.

[0033] Another embodiment or variation has an additional user determined setting for beginner, intermediate and advanced users, in the form of a switch. This setting varies the average threshold which was derived from the learn mode. The beginning level has the highest level of threshold, the intermediate level has a middle level of threshold and the advanced level has the lowest threshold before the output generator is signaled by the controller.

[0034] For example, if the controller is set to beginner, the threshold is very high and it takes a large impact for the controller to signal the output generator which in turn generates a signal to the user that is perceivable. The beginner could have a somewhat impactful stride and still not generate a signal to the output generator until a strong impact stride was detected by the controller.

[0036] Embodiments of the present invention reduce impact on your body by alerting with an alarm, for example a loud beep, when the user is impacting the ground with a harmful or inefficient stride. In this way, runners can monitor their strides while at the same time avoid potential injuries by moving using safer strides. This results in less stress to the entire body. In one embodiment, a runner can set his or her running skill level before they begin to run. In this way, a beginner can use a more forgiving setting than a setting used by a highly skilled runner. This embodiment alerts the user with a beep whenever a set threshold is reached, and this beep serves to notify the runner and/or the trainer to run with strides that have less impact and thus more efficiently. Further, the challenge of perfecting one'[[“]]s stride can be entertaining to the user and further serve as a distraction to the runner during times of prolonged activity. In another example of a use for an embodiment of the present invention, when a runner is receiving information that she or he is impacting harder than she or he would like, and the runner is unable to modify their running stride to create ground strikes with less impact, the runner can instead move to a more forgiving surface, such as a running track or a sandy beach. The present

invention helps athletes run longer, and it helps them more run more frequently because it helps prevent injuries.

[0045] FIG. 1 also shows display 18 with a value of "64" indicating the level of the current or recent impact. In this embodiment, the number displayed is scaled in direct proportion to the impact level, with no impact displaying zero and the greatest sensed impact, within the maximum limit of the sensor, being ninety nine. Sensor 20'[["]]s position, which would not be externally visible to the user, is indicated by the dashed line. In this embodiment, it is incorporated into the sole of the shoe.

IN THE CLAIMS:

What is claimed is:

[~~c1~~]1. A body force alarming apparatus comprising:

a housing;

a power supply;

a piezo sensor;

a controller;

an output generator;

wherein said piezo sensor is accommodated within a user's shoe and connected to said controller;

wherein said piezo sensor, controller and said output generator are connected to said power supply;

wherein said controller, output generator and power supply are accommodated within said housing;

wherein said controller is connected to said output generator,

wherein said controller is set to generate a signal to the output generator when a threshold level of force signal is received from said piezo sensor;

wherein said sensor signals said controller when force from an impact is applied to said piezo sensor; and

wherein said controller signals said output generator when one or more signals indicating threshold levels of force have been reached; and

wherein said output generator generates a perceivable signal in response to a signal from said controller.

~~[c2]~~2. A body force alarming apparatus of claim 1, wherein said piezo sensor is comprised of two or more piezo sensors to provide feedback when one or more levels of force are sensed.

~~[c3]~~3. A body force alarming apparatus of claim 1, further comprising a means to automatically adjust the controller.

~~[c4]~~4. A body force alarming apparatus of claim 1, further comprised of a microcontroller wherein said microcontroller, once activated by a user with a switch, performs the steps of:

recording one or more amounts of impact for a predetermined period of time;

averaging said amounts of impact recorded over said period of time; and

setting the controller's feedback threshold to an amount equal to the average value.

~~[c5]~~5. A body force alarming apparatus of claim 1, further comprised of a microcontroller wherein said microcontroller, once activated by a user with a switch, performs the steps of:

recording one or more amounts of impact for a predetermined period of time;

averaging said amounts of impact recorded over said period of time; and

setting the controller's feedback threshold to an amount above or below the average value.

~~[c6]~~6. A body force alarming apparatus of claim 1, wherein said output generator has a separate power source and said controller and said output generator are wirelessly connected.

~~[c7]~~7. A body force alarming apparatus of claim 1, wherein said output generator is separately attached to the body of the user.

~~[c8]~~8. A body force alarming apparatus of claim 1, wherein said controller is separately attached to the body of the user

~~[c9]~~9. A body force alarming apparatus of claim 1, wherein said output generator is separated from the user.

~~[c10]~~10. A body force alarming apparatus of claim 1, wherein said controller is separated from the user.

~~[c11]~~11. A body force alarming apparatus of claim 1, wherein said piezo sensor is an impact transducer.

~~[c12]~~12. A body force alarming apparatus of claim 1, wherein said sensor, controller and feedback generator are accommodated in said person's shoe.

~~[c13]~~13. A body force alarming apparatus of claim 1, wherein said perceivable signal is an audio beep, a musical tone or tones, a click, a vibration, a shock, a pressure applied to the user, or a light emission.

~~[c14]~~14. A body force alarming apparatus of claim 1, wherein said controller is preset to generate two or more signals to the output generator when two or more corresponding signals are received from said sensor which are at or above the two or more corresponding threshold levels of force.

~~[c15]~~15. A body force alarming apparatus of claim 1, wherein said output generator generates two or more corresponding perceivable distinct signals in response to each corresponding signal from said controller.

~~[c16]~~16. A body force alarming apparatus of claim 1, further comprising a low battery sensor wherein a low battery alarm is produced when a low battery is detected.

~~[c17]~~17. A body force alarming apparatus of claim 1, further comprising an on/off switch.

~~[c18]~~18. A body force alarming apparatus of claim 1, further comprising a digital display for displaying one or more amounts of force applied to the sensor.

~~[c19]~~19. A body force alarming apparatus of claim 1, further comprising a beginner setting, and intermediate setting and an advanced setting, wherein when the controller is set to beginner, intermediate or advanced and the corresponding threshold is set to take a large, medium or small impact for the controller to signal the output generator.

~~[c20]~~20. A body force alarming apparatus of claim 1, further comprising a wireless receiver to remotely receive output data transmitted by the controller.

~~[c21]~~21. A body force alarming apparatus of claim 1, further comprising a wireless receiver to remotely receive output data transmitted by the sensor.

~~[c22]~~22. A body force alarming apparatus of claim 1, further comprising a wireless receiver to remotely receive output data transmitted by the output generator.

~~[c23]~~23. A body force alarming apparatus of claim 22, wherein said output data is recorded.

~~[c24]~~24. A body force feedback method comprising the steps of:

setting the controller to generate a signal to the output generator when a threshold level of force signal is received from a piezo sensor;

signaling said controller with the sensor when an amount force from an impact is applied to said sensor;

signaling an output generator when one or more signals from said sensor indicate that one or more predetermined threshold levels of force have been sensed; and

generating a perceivable signal with said output generator in response to a signal from said controller wherein the steps are performed using an apparatus comprised of:

a housing;

a power supply;

said piezo sensor;

said controller; and

said output generator;

wherein said piezo sensor is accommodated within a user's shoe and connected to said controller;

wherein said piezo sensor, controller and said output generator are connected to said power supply;

wherein said controller, output generator and power supply are accommodated within said housing; and

wherein said controller is connected to said output generator.

~~[c25]~~25. A body force alarming method of claim 24, wherein said piezo sensor is comprised of two or more piezo sensors to provide feedback when one or more levels of force are sensed.

~~[c26]~~26. A body force alarming method of claim 24, wherein said apparatus is further comprised of a means to automatically adjust the controller.

~~[c27]~~27. A body force alarming method of claim 24, wherein said apparatus is further comprised of a microcontroller wherein said microcontroller, once activated by a user with a switch, performs the steps of:

recording one or more amounts of impact for a predetermined period of time;

averaging said amounts of impact recorded over said period of time; and

setting the controller's feedback threshold to an amount equal to the average value.

~~[c28]~~28. A body force alarming method of claim 24, wherein said apparatus is further comprised of a microcontroller wherein said microcontroller, once activated by a user with a switch, performs the steps of:

recording one or more amounts of impact for a predetermined period of time;

averaging said amounts of impact recorded over said period of time; and

setting the controller's feedback threshold to an amount above or below the average value.

~~[c29]~~29. A body force alarming method of claim 24, wherein said output generator has a separate power source and said controller and said output generator are wirelessly connected.

~~[c20]~~30. A body force alarming method of claim 24, wherein said output generator is attached to the body of the user.

~~[c31]~~31. A body force alarming method of claim 24, wherein said controller is attached to the body of the user

~~[c32]~~32. A body force alarming method of claim 24, wherein said output generator is separated from the user.

~~[c33]~~33. A body force alarming method of claim 24, wherein said controller is separated from the user.

~~[c34]~~34. A body force alarming method of claim 24, wherein said piezo sensor is an impact transducer.

~~[c35]~~35. A body force alarming method of claim 24, wherein said sensor, controller and feedback generator are accommodated in said person's shoe.

~~[c36]~~36. A body force alarming method of claim 24, wherein said perceivable signal is an audio beep, a musical tone or tones, a click, a vibration, a shock, a pressure applied to the user, or a light emission.

~~[c37]~~37. A body force alarming method of claim 24, wherein said controller is preset to generate two or more signals to the output generator when two or more corresponding signals are received from said sensor which are at or above the two or more corresponding threshold levels of force.

~~[c38]~~38. A body force alarming method of claim 24, wherein said output generator generates two or more corresponding perceivable distinct signals in response to each corresponding signal from said controller.

~~[c39]~~39. A body force alarming method of claim 24, wherein said apparatus is further comprised of a low battery sensor wherein a low battery alarm is produced when a low battery is detected.

~~[c40]~~40. A body force alarming method of claim 24, wherein said apparatus is further comprised of an on/off switch.

~~[c41]~~41. A body force alarming method of claim 24, wherein said apparatus is further comprised of a digital display for displaying one or more amounts of force applied to the sensor.

~~[c42]~~42. A body force alarming method of claim 24, wherein said apparatus is further comprised of a beginner setting, and intermediate setting and an advanced setting, wherein when the controller is set to beginner, intermediate or advanced and the corresponding threshold is set to take a large, medium or small impact for the controller to signal the output generator.

~~[c43]~~43. A body force alarming method of claim 24, wherein said apparatus is further comprised of a wireless receiver to remotely receive output data transmitted by the controller.

~~[c44]~~44. A body force alarming method of claim 24, wherein said apparatus is further comprised of a wireless receiver to remotely receive output data transmitted by the sensor.

~~[c45]~~45. A body force alarming method of claim 24, wherein said apparatus is further comprised of a wireless receiver to remotely receive output data transmitted by the output generator.

~~[c46]~~46. A body force alarming method of claim 45, wherein said output data is recorded.